SOV-120-58-3-17/33

AUTHORS: Kushnir, Yu. M., Myrykov, V.G., Butslov, M. M. and Bordovskiy, G. A.

TITLE: Application of an Electron-Optical Converter in an Electron Microscope (Primeneniye elektronno-optichesk ogo preobrazovatelya v elektronnom mikroskope)

PERIODICAL: Pribory i Tekhnika Eksperimenta, 1958, Nr 3, pp 73-75 and 2 plates (USSR)

ABSTRACT: Electron-optical converters may be used in the observation of images of low brightness in electron microscopes. It is shown that the use of such converters enables one to observe and focus images in both transmission and reflection microscopes with current densities at the screen of 10^5 - 10^6 electrons per cm^2 and thus study objects which under the more usual conditions may become damaged. The microscope employed for this work was the MEM-50 described in Ref.2. The principle of the method is shown in Fig.1. Here 1 is the tube of the transmission or reflection microscope, 2 is the observation window, 3 is the photographic camera, 4 is the screen of the electron microscope, 5 is the objective, 6 is the photocathode of the converter, 7 is the cascade electron optical converter, 8 is the screen of the converter, 9 is an additional objective,

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Application of an Electron-Optical Converter in an Electron Microscope

10 is the photographic camera and 11 is a probe (Faraday cap) used to measure the electron current. Fig. 5 shows an electron microphotograph of the surface of a piece of copper covered by an electrolytically deposited layer of nickel. This photograph was taken with a reflection microscope. Observation and focussing in this case could only be carried out using a cascade electron-optical converter. There are 6 figures, no tables and 3 references, of which 2 are Soviet and 1 is French.

SUBMITTED: September 15, 1957.

1. Electron microscopes--Equipment 2. Electron optics--Applications

AUTHOR: Kushnir, Yu. M.

TITLE: Soviet Electron Microscopes (Sovetskiye elektronnyye mikroskopy)

PERIODICAL: Pribory i tekhnika eksperimenta, 1958, Nr 4, pp 3-18 (USSR)

ABSTRACT: Eight distinct designs of Soviet electron microscope are described, dating back to the first (1946) models. Transmission microscopes are first reviewed; particular attention is given to the universal models (100 kV maximum), i.e. the UEM-100 and UEMB-100 (magnetically focussed), especially the latter, which is illustrated in Fig.2. The latter of these is of first-class resolution. The resolution magnifications, accelerating voltages and numbers produced are listed (in that order) in the table. The latest model, the EM-5 (electrostatically focussed), is illustrated in Fig.3; this is the best representative of the second class of microscope (medium resolution). The first Soviet electron microscope (the EM-3) is illustrated in Fig.4; this was of comparatively low resolution (60 Å). The UEM-100 is illustrated in Fig.5. Fig.6 shows the small-size MESM-45 (45 kV, electrostatic) which is the latest in a series of such instruments. Electron microscopes for use in reflection, etc.

Soviet Electron Microscopes

(i.e. with thick objects) are then reviewed more briefly, including field emission types, systems using thermionic and secondary emission, etc. The EEM-50 (50 kV) for the latter purposes is illustrated in Fig.7. Dark-field microscopes are only considered very briefly at the end. The paper contains 8 figures, 1 table and 10 Soviet references.

SUBMITTED: May 29, 1958.

Card 2/2

AUTHORS: Sushkin N. G., Kushnir Yu. M. 57-28-4-35/39

TITLE: On the Action of ~~Electrons Upon~~ Multilayer Photographic Films (O deystvii elektronov na mnogosloynyye fotoplenki)

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki 1958 Vol. 28, Nr 4 pp. 908-909 (USSR)

ABSTRACT: For the determination of the behavior of a multilayer photographic film on irradiation by electrons the authors performed special experiments, the results of which are given in this paper. The experiments were performed in two electron-microscopes: an electron microscope 3 M-100 (References 1, 2) and a reflection-electron-microscope of special construction. It is shown that the exposure of the multilayer colorphotographic film to electrons of different velocities causes a different coloring of the film. It is further shown that the color shade depends on the velocity of the electrons. With a modification of the velocity of electrons mainly the shade of the film changes. On a modification of the time of exposure by the beam and of the intensity mainly the saturation of the color changes.

Card 1/2

AUTHORS: Krasovskiy, V. I., Kushnir, Yu. M., Bordovskiy, G. A. 53-64-3-2/8

TITLE: The Investigation of Corpuscular Radiation of the Sun by Means of an Artificial Earth Satellite (Issledovaniye korpuskulyarnogo izlucheniya Solntsa s pomoshch'yu iskusstvennogo sputnika Zemli)

PERIODICAL: Uspekhi Fizicheskikh Nauk, 1958, Vol. 64, Nr 3, pp. 425-434 (USSR)

ABSTRACT: First the authors give a survey on the present stage of the problem of corpuscular sun radiation, and they also report on earlier works dealing with the same subject. An artificial satellite can be used for the investigation of corpuscular sun radiation in two different ways. First, the chemical composition of corpuscular flux can be determined directly by mounting a special mass-spectrometer s on the satellite. Such apparatus can be constructed. The most effective method of registration, however, is connected with a photographic process; this makes necessary a special construction of the satellite

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and the material obtained must be brought down to earth. Besides, a strict orientation of the apparatus in a certain direction would be necessary. The second possibility which can be realized at present is the investigation of the distribution and the penetration of the corpuscles at various geomagnetic longitudes and latitudes, especially during the day. This makes possible a checking of the various hypotheses on the nature of corpuscular flux. The apparatus projected and being built for this purpose is shown in a diagram. A fluorescing screen serves as indicator of the corpuscles. The radiation of the fluorescent screen is registered by a photocell, and then the photoelectric current is amplified, stored, and transferred by a corresponding radio-telemetric apparatus. A metal foil fixed in front of the fluorescent screen makes possible a coarse estimation of the ranges of corpuscles and moreover it protects the fluorescent screen and the photocell against the direct action of sun radiation. A shutter restricts the angle of the action of corpuscles. The apparatus described here can at the same time be used with apparatus for the inve-

The Investigation of Corpuscular Radiation of the Sun by Means of an Artificial Earth Satellite 53-64-3-2/8

stigation of x-radiation of the sun and the micro-meteorites. The soft corpuscular radiation of the sun can be determined only without metal foils at night when there is no sunlight. In using it this way, the apparatus can be switched on or off by a special control signal of the present course device. There are 5 figures and 38 references, 11 of which are Soviet.

1. Sun--Radiation 2. Particles--Photographic analysis 3. Satellite vehicles--Applications 4. Intersteller matter--Analysis

Card 3/3

KUSHNIR, Yu. M.

11 СЕКЦИЯ ЭЛЕКТРОННОЙ МИКРОСКОПИИ

Руководитель секции А. А. Лебедев

12 июня
(с 10 до 16 часов)

П. А. Стоянов,
В. В. Полосатов

Электронный микроскоп УЭМВ 100

А. И. Кабанов,
Ю. М. Кушнир

Универсальный электростатический анализатор энергии на 75 кв и некоторые вопросы его применения

Н. М. Попов

Электронный микроскоп-электронограф с ускоряющим напряжением 100 кв и перспективы использования электронно-оптических свойств для исследования структуры вещества

Н. Г. Сушкина

О возможности применения электронного микроскопа для исследования объектов в атмосфере газов и в жидком состоянии.

13 июня
(с 18 до 22 часов)

З. Я. Берестнева

Использование электронной микроскопии для исследования дисперсных систем и высокомолекулярных соединений

Ю. А. Скаков

Электронно-микроскопические исследования структурных несовершенств в металлах и сплавах

12 СЕКЦИЯ РАДИОВЕЩАНИЯ, ЭЛЕКТРОАКУСТИКИ И ЗВУКОЗАПИСИ

Руководитель И. Е. Горон

9 июня
(с 10 до 16 часов)

Б. А. Шкарр

Способы повышения устойчивости работы систем усиления речи

Г. С. Гохман

Исследование распределения во времени мгновенных значений статистических сигналов

report submitted for the Centennial Meeting of the Scientific Technological Society of Radio Engineering and Electrical Communications im. A. S. Popov (VNORiE), Moscow, 8-12 June. 1959

KUSHNIR, Yu.: KRASOVSKII, V.: BORDOVSKII, G.

"Examining corpuscular raidation of the sun through artificial earth sattelites"

Pokroky Matematiky, Fysiky a Astronomie. Praha, Czechoslovakia. Vol. 4, no. 1, 1959

Monthly list of East European Accessions (EEAI), LC, Vol. 8, No. 6, Jun 59, Unclas

SOV/109-4-6-13/27

AUTHORS: Der-Shvarts, G.V. and Kushnir, Yu.M.

TITLE: On the Problem of the Lens Achromatisation and the Scaling Distortion Correction in Reflex Electron Microscopy (K voprosu ob akhromatizatsii linz i korrektsii masshtabnykh iskazheniy v otrazhatel'noy elektronnoy mikroskopii)

PERIODICAL: Radiotekhnika i elektronika, 1959, Vol 4, Nr 6, pp 1002 - 1007 (USSR)

ABSTRACT: The chromatic aberration in a reflex microscope is comparatively strong and reduces the resolving power of the system. However, if the irradiation angle θ_1 and the observation angle θ_2 are small, the resolving power can be increased. The reduction in the angle θ_2 leads to scaling distortions. The problem of eliminating or reducing the chromatic aberration (achromatisation) was investigated experimentally by employing a microscope, type EM-100. It was found that the chromatic aberration could be reduced by increasing the optical power of the

Card1/2

On the Problem of the Lens Achromatisation and the Scaling Distortion Correction in Reflex Electron Microscopy

lens (Ref 5). In practice this amounted to reducing the focal length of the lens. The resulting achromatisation increases the resolving power of the microscope to about 600 Å. The scaling distortion can also be partially eliminated by introducing a cylindrical lens into the column of the microscope. By this means, the scaling ratio of about 2 could be achieved for the observation angles of up to 8°. The microscope thus corrected could be successfully employed in metallographic investigations. There are 6 figures and 11 references, of which 3 are English, 2 French, 3 German and 3 Soviet.

SUBMITTED: March 17, 1958

Card 2/2

AUTHORS: Levkin, N. P., Kushnir, Yu. M. SOV/48-23-4-21/21

TITLE: A New Model of a Universal Electronograph With 100 kv With an Armored Supply (EG-100A) (Novaya model' universal'nogo elektronografa na 100 kV s bronirovannym vvodom (EG-100A))

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1959, Vol 23, Nr 4, pp 531 - 536 (USSR)

ABSTRACT: The instrument is destined for the investigation of solid and gaseous substances by means of electron diffraction. First, the parameters of the instrument are given and the formula for the computation of the resolution is written down. As an example, figure 1 shows a microphotogram taken with this instrument. The chief parts of the latter are the electron gun with 100 kv accelerating voltage and armored supply as well as the two magnetic lenses. Figures 2 and 3 depict and describe the construction, as well as the adjustment of the individual parts. A large object chamber having a length of 400 mm and one 200 mm long make it possible to place the object at distances of 350 mm or 400 mm, respectively, from the image screen. A mechanism allows the object to be shifted in a vertical plane to the optical axis. The camera and the vacuum system are accurately described.

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A New Model of a Universal Electronograph With 100 kv SOV/[illegible]-21/21
With an Armored Supply (EG-100A)

Among the electrical facilities special mention is made of the oxide cathode and the coreless transformer, the latter because of its little disturbing magnetic field. The high voltage exhibits the steps of 40, 60, 80 and 100 kv and its fluctuation amounts to 0.003%-0.006%. The stabilization of the high voltage and of the lens current is illustrated in short and the compensation of the electron background appearing on the image screen during the investigation is described. A few structural details are discussed and relative pictures are shown. The conclusion of the paper is devoted to the investigation of the gas molecules and volatile substances. There are 7 figures and 2 Soviet references.

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USCOMM-DC-61,352

KUSHNIR, Yu. M.

PHASE I BOOK EXPLOITATION SOV/4557

Akademiya nauk SSSR. Institut metallurgii

Metallurgiya, metallovedeniye, fiziko-khimicheskiye metody issledovaniya (Physicochemical Research Methods in Metallurgy and Metal Science) Moscow, Izd-vo AN SSSR, 1960. 151 p. (Series: Its: Trudy, vyp. 6) 3,000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut metallurgii imeni A.A. Baykova.

General Ed.: I.P. Bardin, Academician (Deceased); Resp. Eds. for this Vol.: I.B. Borovskiy, Doctor of Physics and Mathematics, and K.P. Gurov, Candidate of Physics and Mathematics; Ed. of Publishing House: K.P. Gurov, Candidate of Physics and Mathematics; Tech. Ed.: O.M. Gus'kova.

PURPOSE: This collection of articles is intended for researchers in metallurgy and metal science and for scientists engaged in developing physicochemical methods of analysis.

Physicochemical Research Methods (Cont.) SOV/4557

COVERAGE: The collection contains 21 studies by members of the Laboratoriya fizicheskikh metodov issledovaniya (Laboratory of Physical Analysis Methods) of the Institut metallurgii imeni A.A. Baykova AN SSSR (Metallurgical Institute imeni A.A. Baykov, Academy of Sciences USSR), published in 1958-59. The articles are concerned with the experimental and theoretical study of physical characteristics of diluted solid solutions and compounds with special properties. The purpose of these studies is to establish the interrelation between the electronic structure of atoms and the structural characteristics of metallic compounds of systems. Some of the articles contain results obtained by applying new physical analysis methods, including the x-ray spectrum method (for analyzing the composition of microvolumes of alloys) and the microfocused x-ray spectroscopic method. Other articles describe the new RSASh-2 and RSASh-ZD apparatus used in the analysis. The first article, by I.B. Borovskiy, deals with the accomplishments and trends of Soviet research in metal science and metallurgy. References accompany each article. Also included is a bibliography containing 383 works by members of the Metallurgical Institute imeni A.A. Baykov. This bibliography was first published in 1956.

Physicochemical Research Methods (Cont.) SOV/4557

Card 4/6

69903
S/109/60/005/04/ 018/028
E140/E435

24.6200

AUTHORS: Kushnir, Yu.M., Kabanov, A.N. and Krutyakova, L.N.

TITLE: Measurement of Energy Loss in Gases of 70 keV Lithium Ions by an Electrostatic Analyser

PERIODICAL: Radiotekhnika i elektronika, 1960, Vol 5, Nr 4, pp 672-675 (USSR)

ABSTRACT: The 75 keV electrostatic electron velocity analyser, previously described in Ref 1, is adapted by a reversal of the high-voltage rectifier and substitution of a lithium ion source for the electron source. Inelastic scattering of the lithium ions in interaction with helium, argon, oxygen, nitrogen and air is studied. The spectra obtained agree well with the quantum-theoretical interaction energies and indicate the possibility of using the electrostatic analyser to study the fine effects of inelastic interaction not only of electrons but of any charged particles. Introduction of electrometric methods for recording the spectra will permit estimating not only the energy losses but the effective sections of the processes of inelastics gathering of charged particles. There are 2 figures (plate).

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4

S/109/60/005/06/013/021
E140/E163

24.6200

AUTHORS: Kabanov, A.N., Kushnir, Yu.M., and Krutyakova, L.N.

TITLE: Measurement of 70 keV-Electron Energy Losses in Gases by an Electrostatic Analyser

PERIODICAL: Radiotekhnika i elektronika, 1960, Vol 5, Nr 6, pp 981-985 (USSR)

ABSTRACT: The interaction of a 70 keV electron beam with atomic and molecular gases was carried out using an electrostatic electron-velocity analyser (Refs 1-4) with resolution of the order of 150000 : 1. The electron beam current did not usually exceed 5 μA while the gas pressure was in the range 1×10^{-3} to 1×10^{-2} mm Hg. The electron energy loss was measured by the method described in*Ref 6. Experiments were carried out with helium, neon and argon, oxygen, nitrogen and nitric oxide, and carbon tetrachloride (at 45 kV). For the monoatomic gases certain loss lines detected in experiments with slow electrons are absent from the fast electron spectra while for molecular gases all values of loss energy detected in experiments with slow electrons occur as well for the 70 keV electrons. The energy

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80588

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E140/E163

Measurement of 70 keV-Electron Energy Losses in Gases by an Electrostatic Analyser

losses agree closely with the quantum-mechanical theoretical values.
There are 1 figure, 4 tables and 11 references, of which 4 are German, 6 Soviet and 1 English.

Card
2/2

SUBMITTED: June 6, 1959

*Radiotekhnika i elektronika, 1960, Vol.5, Nr4, pp 672-675 (USSR)

21595

S/109/60/005/010/018/031
E033/E415

26231 2

AUTHORS: Kabanov, A.N. and Kushnir, Yu.M.

TITLE: Some Applications of a Universal Electrostatic Electron-Velocity Analyser at 75 kV

PERIODICAL: Radiotekhnika i elektronika, 1960, Vol.5, No.10, pp.1703-1708

TEXT: This paper was presented at the 9th All-Union Conference on Cathode Electronics, Moscow, 1959.

The article gives the results of measuring the characteristic energy losses of 75 kV electrons in thin films of various materials, and also of energy losses of electrons backscattered (reflected) from thick samples. The principles and special construction of the universal electrostatic electron-velocity analyser used in the investigation have been previously described, but the basic features are reviewed in this article. The analyser has a special chamber for investigation of electron energy loss in gases. A four-lens electron-optical system together with an intermediate photo-camera enables electron-microscopic and electronographic investigation simultaneously with measurement of the characteristic energy loss. A high-voltage rectifier and a corresponding ion-source permits the

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apparatus to be used as an ion-energy analyser. A power pump and liquid nitrogen cooling enable low pressures of (3 to 5) x 10^{-6} mm Hg to be maintained in the column of the analyser. For electrons and ions with 75 kev energies, the dispersion is of the order of 0.2 mm/ev and the resolving power is 150000 : 1 (0.5 ev). The measured values of the characteristic energy losses in thin films of different materials are tabulated in Table 1. For comparison, the practical results obtained by G.Mollenstedt (Mo), L.Marton and L.Leder (M and L) and Watanabe (W) at 25 to 35 kv are given in the same table. Losses calculated by A.Ya.Vyatskin's formula (Ref.11) ($\varepsilon = (150/a^2)\eta$ for a cubic lattice, where a is the lattice constant, η the reverse lattice vector) and by D.Pines' formula (Ref.12) ($\hbar\omega = \hbar(4\pi ne^2/m)^{1/2}$ where $\hbar$ is Planck's constant, m, e, n are the mass, charge and density of the valence electrons respectively) are also given in the same table. The characteristic energy losses of 75 kev electrons reflected from various materials (aluminium, zinc, tantalum, nickel, molybdenum, niobium) are given in Table 2. The pressure was 5 x 10^{-6} mm Hg and the target (3 - 4 mm wide and 0.08 - 0.10 mm thick) was heated by a d.c. current to more than 1000°C. The temperature was controllable and was

measured by an optical pyrometer. For comparison, results (Ref.13) obtained by W.Klein (K) at 35 kev, (1 to 5) x 10^{-4} mm Hg and 150 to 200°C are given in the same table. The energy loss dependence on temperature was investigated for nickel and iron over the temperature range 0 to 1000°C. The energy loss of electrons in nickel did not depend on temperature, but in iron the energy losses change by a "jump" at the temperature corresponding to the $\alpha - \gamma$ transition (above 910°C). These results accord with the results published by I.B.Borovskiy and V.V.Shmidt of the Institut metallurgii im A.A.Baykova AN SSSR (Institute of Metallurgy imeni A.A.Baykov, AS USSR). There are 3 figures, 3 tables and 16 references: 8 Soviet and 8 non-Soviet.

SUBMITTED: December 21, 1959

Card 3/5

83572

S/056/60/038/005/005/050
B006/B070

24.7700

AUTHORS: Borovskiy, I. B., Kabanov, A. N., Kushnir, Yu. M., Shmidt, V. V.

TITLE: The Effect of Temperature on the Characteristic Energy Losses of Electrons in Iron

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 38, No. 5, pp. 1383-1387

TEXT: Borovskiy and Shmidt (Ref. 1) studied the fine structure of the main K-absorption edge of X-rays in iron and found that when the absorber is heated beyond the $\alpha \rightarrow \gamma$ transition temperature (910°C) this structure is much altered. A relation between the fine structure and the characteristic energy losses of the electrons at room temperature was also discovered by them. There are many publications dealing with the nature of the characteristic energy losses of electrons when passing through thin films of matter. Some of the models - the inelastic collisions with valence electrons, and the interaction between the charged particles and the totality of the valence electrons - are discussed in the introduction of the present paper. This interaction leads to the excitation of collective oscillations of the

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The Effect of Temperature on the Characteristic Energy Losses of Electrons in Iron

S/056/60/038/005/005/050
B006/B070

electron gas (plasma oscillations). The investigations described in the present paper show that a compromise between the following two points of view may prove correct, namely, that the energy losses are due to the excitation of plasma oscillations, or that they are due to single-electron transitions between energy bands. The experimental method is described in detail. An electrostatic analyzer of the electron velocities was used, which had a resolution of 0.5 ev at an accelerating voltage of 75 kev. The samples were 0.08 - 0.10 mm thick, and the electron beam had an energy of 70 - 75 kev. The experiments were performed in vacuum ($5 \cdot 10^{-6}$ torr). The characteristic energy losses of the electrons were measured for the following temperatures of the samples: 20°, 800°, and 930°C. Two measurements for checking were made at 600°C. The curves taken at 20° and 930°C (Fig.) show the energy losses (blackening of the photographic plate) as a function of the energy. The form of the curves is found to be independent of the temperature. The first characteristic loss in α-Fe (cubic, body-centered, a = 2.86 A) at 20°C is (7.5±0.7)ev; the following two lines at 14.8 and 21.5 ev may be considered to be multiples of the first. In γ-Fe (cubic, face-centered, a = 3.60 A at 940°C) there are essential deviations. Here, the first characteristic loss is (11.6±0.6)ev; the following lines at

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The Effect of Temperature on the Characteristic Energy Losses of Electrons in Iron

S/056/60/038/005/005/050
B006/B070

23 and 33 ev may again be taken to be its multiples. A discussion of the results from the points of view of single-electron transitions and the excitation of plasma oscillations shows that further studies are necessary for a final clarification of this effect. The numerical data of measurement are listed in two tables. There are 1 figure, 2 tables, and 15 references: 4 Soviet, 7 US, 1 German, 1 Japanese.

ASSOCIATION: Institut metallurgii Akademii nauk SSSR
(Institute of Metallurgy of the Academy of Sciences USSR)

SUBMITTED: November 4, 1959

Card 3/3

25990
S/560/61/000/006/008/010
E032/E314

9,9100

AUTHORS: Krasovskiy, V.I., Shklovskiy, I.S., Gal'perin, Yu.I., Svetlitskiy, Yo.M., Kushnir, Yu.M. and Bordovskiy, G.A.

TITLE: Discovery of Approximately 10 keV Electrons in the Upper Atmosphere

PERIODICAL: Akademiya SSSR. Iskusstvenyye sputniki Zemli. No. 6. Moscow, 1961, pp. 113 - 126

TEXT: Prior to experiments carried out with the aid of artificial Earth satellites, it was assumed that the natural glow, heating, and ionization of the upper atmosphere was largely due to hard electromagnetic radiation of solar origin. It was considered that corpuscular radiation (protons, α-particles and electrons) could only penetrate the atmosphere in the polar regions and thereby give rise to geomagnetic disturbances and aurorae. It was found that aurorae were frequently initiated by protons with a considerable velocity spread. However, in many cases, hydrogen-emission was not observed and the appearance of aurorae was provisionally associated with electrons having

Discovery of ....

energies up to a few hundreds or thousands of eV. An attempt was then made by Krasovskiy et al (Ref. 3 - UFN, 64, 425, 1958) to detect these electrons from the third Soviet artificial Earth satellite. The apparatus employed consisted of two very thin phosphors covered by aluminium foils. The scintillations were recorded by photomultipliers and the amplified photomultiplier signal was stored and later telemetered to Earth. Owing to the presence of the aluminium foils (which were of differing thicknesses) it was possible to estimate both the intensity and the energy of the electrons which were most effective in exciting the phosphors. A particular feature of this apparatus was that it was sensitivie only to electrons and did not respond to protons and photons of comparable energy. The apparatus indicated the presence of large electron currents at altitudes up to 900 km in the region of the southern part of the Pacific Ocean, the energy of these electrons being of the order of 10 keV. These currents were often so large that the apparatus gave off-scale readings since such high currents were not expected. In the case of these off-scale readings the energy

Discovery of ....

flux exceeded 100 erg $cm^{-2}sec^{-1}$ at altitudes up to 1 900 km from the Earth's surface. Fig. 2 shows the calibration curves for the two detectors employed in this experiment. The dashed lines correspond to aluminium foil of 0.8×10^{-3} g/cm^2 and the continuous lines correspond to aluminium foil of 0.4×10^{-3} g/cm^2. The numbers on these lines indicate the energy of the electrons in keV. These calibration curves were obtained in laboratory experiments using parallel beams of mono-energetic electrons. The current density of monochromatic electrons (A/cm^2) is plotted along the vertical axis and the telemetric channel number, which is proportional to the logarithm of the photomultiplier current, along the horizontal axis. Fig. 3 shows the difference ΔK between the logarithmic-scale divisions of the two detectors as a function of the energy of the electrons used in the calibration. The ratio of the photo-currents of the two detectors depends on the energy of the electrons or, more precisely, on the form of the energy spectrum. This relation was determined in

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E032/E314

Discovery of ....

preliminary laboratory experiments with mono-energetic electrons. The form of the energy spectrum recorded by the satellite is unknown and comparison of the readings produced by the two detectors can only be used to estimate an equivalent energy. This equivalent energy E_{equiv} is defined as the energy of a monochromatic beam which gives the same photo-current ratio for the two detectors as the observed value. Proceeding along these lines one can also define an equivalent current and an equivalent energy flux. It can easily be shown that these equivalent quantities give, in fact, the lower limits of the measured quantities. Consideration of the telemetric records, a number of which are reproduced in the present paper, showed that the most frequently recorded energies occurred in the neighbourhood of 14 keV. Since the sensitivity of the apparatus is considerably higher for high-energy electrons, it follows that in the case of non-monochromatic electrons the maximum flux corresponds to an energy below 14 keV. This maximum can be determined if some energy-distribution function

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Discovery of ....

is assumed. It is estimated that the energy flux associated with these currents, which may reach the lower layers of the atmosphere, is at least 1 erg $cm^{-2} sec^{-1}$. The discovery of large currents of 10 keV electrons is of particular importance to the understanding of many geophysical phenomena. For example, it is interesting to note that appreciable intensities of such electrons first appear at the geomagnetic latitude at which increased ionization was previously recorded in the F-layer and which could not be explained by hard electromagnetic radiation of solar origin. The existence of these electron currents may lead to the explanation of ionization irregularities in the upper atmosphere. Acknowledgments are made to S.Sh. Dolginov, V.V. Beletskiy and Yu.V. Zonov for determining the orientation of the apparatus relative to the magnetic field. There are 11 figures and 15 references: 12 Soviet and 3 non-Soviet.

SUBMITTED: December 9, 1959

Card 5/7

S/109/61/006/008/010/018
D207/D304

24.3300

AUTHORS: Der-Shvarts, G.V., Kushnir, Yu.M. Rozenfel'd, L.B., Zaytsev, P.V., Bezlenkin, S.V., Trutneva, I.S., Belenkiy, S.A., Titov, L.A.

TITLE: Certain problems of reflex electron microscopy

PERIODICAL: Radiotekhnika i elektronika, v. 6, no. 8, 1961, 1358 - 1364

TEXT: This paper was presented at the 3rd All-Union Conference on electron microscopy, Leningrad, October 1960. The present article describes an electron reflex microscope based on the design by Ch. Fert, R. Martv, P. Saporte (Ref. 1: C. r. Acad. Sci. 1955, 240, 20. 1975) who have shown that by tilting the illumination system by 15 - 20° in a reflex microscope, a good image may be obtained with small deformation of the scale and a large useful image area. The main deficiency of such a system in an electron microscope is the chromatic aberration; the aberration can be reduced, by reduc-

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ing the diaphragm aperture of the objective which in turn reduces considerably the picture illumination. In the described microscope the increased illumination was obtained by designing a more effective electron gun and by utilizing a light intensifier. Since the definition of a reflex microscope is determined by the diaphragm of the objective, which means that in an electron microscope the efficiency of the electron gun is determined not by electron brightness but by the current density of the sample, several types of gun were investigated; it was found that triple electrode guns of special construction produce a much greater current density than the standard guns normally used in electron microscopes. The special feature of such a gun is the conical shape of the focussing electrode. The dependence of current density j at the cross-over point of the anode current was determined for electrode angles α of 60°, 90° and 120° with depth of penetration h of the tip of the cathode filament (filament dia. 0.12 mm) with respect to the cone apex, as a parameter for maximum current density at U = 60 kV. The temperature of the cathode was 2800°K. The optimum results obtained are

Certain problems of reflex ...

shown. For an electrode with angle $\alpha = 120^0$, $h = 0.5$ mm; for $\alpha = 90^0$ and 60^0, $h = 1.5$ mm. For comparison $j = f(Ia)$ is also drawn for the normal electron gun YEM-100 (UEM-100), in which the tip of the filament is 0.75 mm above the focussing electrode. It may be seen that for $\alpha = 120^0$ the current density is increased by approximately 4.6 times with a current of 250 μA and 7 times with a current of 500 μA. The electron gun is mounted in the illumination system of the microscope. The gun is introduced through a jacketed port and can be mechanically rotated through any angle from 0^0 to 22^0 measured on a vernier scale. The electron optical magnification of the microscope is x2500, resolution about 300 Å. The authors also undertook theoretical analysis of the influence on the finition of imperfect assembly and shape of magnet cores. Since the picture is formed by electrons undergoing considerable decelerations, the axial deformation of the magnet slots and errors in their axial positioning produce a constant magnetic field near the axis and perpendicular to it. Such a field has analyzing properties and may introduce chromatic aberration. The evaluation of such aberrations requires the determination of the corresponding pertur-

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Certain problems of reflex ...

bation potentials, normally evaluated by Bertein's method. It may be shown, however, that this method does not determine the exact boundary conditions necessary for solving the problem of the Laplace equation for perturbation potentials. This problem may be solved exactly only when it is assumed that the perturbation is very small. The modified Mathieu functions may be then reduced to the sums of Bessel functions, whose terms are multiplied by the parameter of the Mathieu equation. In their analysis the authors concluded that there is no general method for evaluating the perturbation potentials and used the integral of an ordinary layer to determine them in the near axial region. The details of the analysis are not given. The poles used had the geometrical form with s/d ratio of 1.5 [Abstractor's note: Symbols d and s not defined]. The authors also investigated the filter lenses in an attempt to increase the resolution of the reflex microscope. In their analysis [Abstractor's note: Details not given] they used the mathematical model of single electrostatic lenses of W. Glaser and P. Schiske (Ref. 13: Optik, 1954, 11, 9, 422; 1954,11, 10. 455; 1955, 12, 5, 253) and of K. Rüdenberg (Ref. 14: J. Franklin Inst. 1948, 246, 4,

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24859

S/109/61/006/008/010/018
D207/D304

Certain problems of reflex . .

311, 246, 5, 377). The analysis showed [Abstracter's note: Details not given] that the resolution of the lens is basically limited by the fact that non-axial achromatic electrons are being focussed in different planes. With an energy [illegible] of electrons of the order of 5-6 eV a background is, therefore, formed in which the picture disappears. There are 10 figures. [illegible] non-Soviet-bloc references. The references [illegible] English-language publications read as follows: [illegible] Einstein, Brit. J. Appl. Phy. [illegible], 49; E.A. Stern [illegible] los. Trans. Roy Soc. London, A, [illegible], 243, [illegible]; G.D. Archard. J. Scient. Instrum. [illegible]; R. [illegible] Inst., 1948, 346, 311; 246, [illegible].

SUBMITTED: February 7, 1961

Card 5/5

KUSHNIR, Yu.M.; FETISOV, D.V.; RASPLETIN, K.K.; POCHTAREV, B.I.; SPEKTOR, F.U.; KABANOV, A.N.; ANISIMOV, V.F.

Scanning electron microscope, an X-ray microanalyzer. Izv.AN SSSR. Ser.fiz. 25 no.6:695-700 Je '61. (MIRA 14:6)
(X-ray microscope)

DER-SHVARTS, G.V.; KUSHNIR, Yu.M.; ROZENFEL'D, L.B.; ZAYTSEV, P.V.; BEZLEPKIN, S.V.

Modernizing the UEM-100 microscope. Izv.AN SSSR.Ser.fiz. 25 no.6:721-724 Je '61. (MIRA 14:6)
(Electron microscope)

S/048/61/025/006/008/010
B117/B212

AUTHORS: Kabanov, A.N. Kushnir, Yu.M., and Fetisov, D.V.

TITLE: Objective recording method of energy spectra of electrons for an electrostatic analyzer

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 25, no. 6, 1961, 748-751

TEXT: The present paper has been presented at the 3rd All-Union Conference on Electron Microscopy, held in Leningrad from October 24 to 29, 1960. The authors have applied the method suggested by Möllenstedt (Ref.4: Möllenstedt G., Dietrich W., Optik, 12, 246 (1955)) for a 75-kv analyzer. For photographic recording of spectra the dispersing element of the analyzer consists of a slit and an analytical lens (Fig. 1 a). The principle of a device, where optical properties of the analytical lens and also the resolution and the intensity of the slit image remain constant, consists in introducing a second slit (Fig. 1 b and B). It is located somewhat below the analytical lens, and is so far away from the optical axis that only those electrons will pass it, whose energies correspond to

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Objective recording method ...

the optimum conditions (R_{opt}). Changing the potential of the central electrode of the analytical lens will keep the quantity R_{opt} constant. The image of the slit can only change its intensity. At the screen it remains unchanged. By adjusting optimum conditions for elastically scattered electrons and by continuous change of the central electrode potential, the number of electrons passing through the second slit is changed and it is possible to obtain easily information on the energy losses of the electrons and on the intensity of the spectral lines. The device can be simplified when using a semi-transparent fluorescent screen, a photo-electron multiplier and an automatic electronic potentiometer of the type ЭПП-09 (EPP-09). Fig. 2 shows a diagram of the dispersing element of the analyzer, the electron gun, and also the device for objective recording of electron energy spectra. Both slits are adjustable. The lower slit may be opened to a width that is sufficient to let the whole spectrum through. Control pictures of the spectrum may be taken with the camera without disturbing the vacuum. A movable photographic plate holder makes it possible to use both recording methods. After the electron beam has passed through the second slit, it hits the semi-transparent fluorescent screen with a short afterglow. The color of the afterglow and the spectral maximum correspond

to the sensitivity of the photocathode of the ФЭУ (FEU) multiplier of type 1С (1S). Organic glass was used as light conductor. The signal of the FEU multiplier is amplified by a d-c amplifier У (U) and is led to the input of the balancing cathode follower КП (KP). This is used to coordinate the amplifier resistor and that of the potentiometer EPP-0.9. The change of the central electrode potential of the analytical lens was done with a ПЛ (PL) potentiometer. The total resistance of the potentiometer was 20 kilohms and its linearity 0.1%. The potentiometer was fed from a battery $Б_2$ (B_2) of type БАС (BAS) having a voltage of 150 v. The high-voltage divider R_2 made it possible to obtain the wanted conditions for the analytical lens, according to the current used for the electron beam. The battery (B_1), which was connected to the electron gun circuit, was used for recording standards for the energy spectra. A change of the resistance R_1 made it possible to adjust the current of the electron beam as necessary. The resolution of the analyser was ~140,000 : 1 and the dispersion 0.2 mm ev-1. Another article will report on the application of the analyser with a device for objective estimation of the lines of energy spectra. There are 5 figures and 5 references: 3 Soviet-bloc and 2 non-Soviet-bloc.

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KUSHNIR, Yu.M.; KABANOV, A.N.

Use of an electrostatic analyzer for studying the energy spectra of electrons reflected from metals. Izv.AN SSSR.Ser.fiz. 25 no.6: 752-753 Je '61. (MIRA 14:6)
(Electrostatics) (Electrons—Spectra) (Electronic measurements)

21399
S/032/61/027/012/012/015
B104/B102

24 3300

AUTHORS: Kushnir, Yu. M., Fetisov, D. V., Rozenfel'd, L. B., and Rozenfel'd, A. M.

TITLE: Domestic electron microscopes for direct examination of compact objects

PERIODICAL: Zavodskaya laboratoriya, v. 27, no. 12, 1961, 1528 - 1535

TEXT: The first part of this review paper deals with field-emission microscopes. A microscope of A. M. Rozenfel'd and P. V. Zaytsev (Izvestiya AN SSSR, ser. fizich. (in print)) and designed for testing thermionic and secondary-electron emitters is described. It differs from the ЭЭМ-7Б(EEM-7B) microscope in its vacuum system (10^{-6} mm Hg) and magnetic objective lens (Fig. 1). 40 kv can be applied between the cathode and anode(distance 2.5 mm) of the objective lens. The resolution can thus be increased to 350 - 400 Å. The objective lens permits the use of both electron and ion sources (Fig. 3). Air, hydrogen, helium, argon, and other ions can be used for exciting secondary electron emission.

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Domestic electron microscopes for ...

In this case, the resolution is approximately 2000 Å. For the ЭЭМ-50 (EEM-50) microscope, an electrostatic immersion objective is being developed, which is designed to stretch and heat the specimen during examination. It can also be used for taking motion pictures of rapid processes. A field-emission microscope with electrostatic optics, developed by B. I. Popov and A. V. Druzhinin (2-e Soveshchaniye po elektronnoy mikroskopii, Nauchno-tekhnicheskoye obshchestvo im. A. S. Popov (annotatsii dokladov), M. (1958); Radiotekhnika i elektronika, no. 8 (1958)), is mentioned. The second part of this paper deals with reflecting electron microscopes which are known to operate like optical reflecting microscopes and have no high resolution owing to the large scattering of electron energies after reflection. At present, neither Russia nor other countries have such industrial electron microscopes. Some Japanese, British, and Russian transmission electron microscopes have attachments for observations in reflected light (УЭМ-100 (UEM-100); УЭМБ-100 (UEMB-100); УЭМВ-100 (UEMV-100)). The third part deals with scanning microscopes whose resolution reaches 500 - 200 Å when operating with secondary electrons. When operating with X-rays, the resolvable distance is

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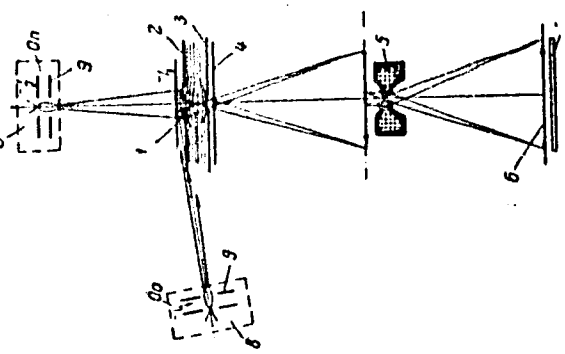
approximately 1 . A resolution of approximately 800 Å was obtained for some objects examined under Soviet scanning microscopes with X-ray analyzers. These microscopes play an important role in the investigation of p-n junctions. The direct X-ray image was studied in previous experiments. In this case, the electrode probe scans a certain part of the specimen surface (0.3·0.3 mm). 50 pictures per sec can be developed with 35 2 (35LKB2B) kinescope. Microchemical analyses with scanning microscopes are also described. The fourth part of the paper deals with reflection electron microscopes, in which accelerated electrons are slowed down and reflected in the microfield of the specimen. The image is determined by this microfield. The theoretical resolution of these microscopes is approximately 1000 Å. Domestic microscopes differ from foreign types in that the images are produced in the vacuum part, whereby the quality of microphotographs is essentially improved. Magnification is about 2000. There are 10 figures and 25 references: 16 Soviet and 9 non-Soviet. The three most recent references to English-language publications read as follows: D. A. Melford a. P. Duncumb. Metallurgia, 59, 205 (1960); P. Duncumb. Brit. J. Appl. Phys., 10, 420 (1959); 11, 169

Domestic electron microscopes for ...

(1960).

Fig. 1. Emission microscope for examination of thermionic and secondary-electron emitters.

Legend: (1) Cathode of immersion objective; (2) focusing electrode; (3) anode; (4) diaphragm, (5) projection lens; (6) screen of finite representation; (7) photoplate; (8) and (9) cathode and anode of source of primary electrons.



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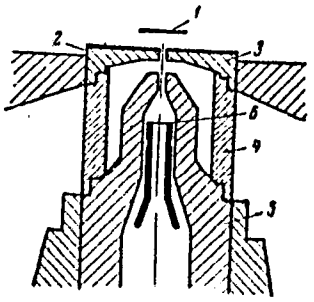
Domestic electron microscopes for ...

Fig. 2. Magnetic objective for emission microscope.
Legend: (1) cathode; (2) anode; (3) upper pole shoe; (4) ring insertion of non-magnetic material; (5) lower pole shoe; (6) diaphragm.

Fig. 3. Objective with ion source.
Legend: (1) and (2) anode and cathode of ion source; (3) and (4) cathode and anode of objective; (5) pole shoes of objective.

Fig. 2



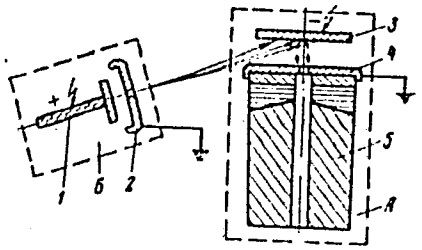


Fig. 3

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S/109/62/007/005/001/021
D201/D307

AUTHOR: Kushnir, Yu.M.

TITLE: Electron microscopy (A short survey of the present state of instrumentation, some of the applications and related problems of electron optics)

PERIODICAL: Radiotekhnika i elektronika, no. 5, 1962, 747 - 781

TEXT: A survey presented at the 3rd All-Union Conference on electron-microscopy (October 1960). All modern Western and Soviet types are presented: Standard high- and low-voltage, electron-emission, scanning, reflex and mirror electron microscopes, together with the technical data of some Soviet-bloc and non-Soviet-bloc instruments based on the principles of electron-microscopy. The latter include electron analyzers, phase and electron interferometer microscopes, x-ray microanalyzers and electronographs. There are 17 figures, 3 tables and 204 references.

SUBMITTED: April 29, 1961

Card 1/1

S/046/63/027/003/020/025
B106/B238

AUTHORS: Kushnir, Yu. M., Fetisov, D. V., Raspletin, K. K., Pochtarev, B. I., Spektor, P. U., Curova, R. P., Tokarev, I. D., Osipov, V. N., and Pavlov, V. A.

TITLE: A modified raster microscope - local X-ray microanalyzer and its use

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 27, no. 3, 1963, 415-419

TEXT: A modified scanning electron microscope - local X-ray microanalyzer is described briefly, and a few data are on its use in investigating metals, minerals and semiconductors presented. The crystal X-ray spectrometer of the apparatus makes it possible to analyze the radiation of elements from magnesium to uranium. The dead time of the counter tube does not permit of obtaining qualitative X-ray patterns when the scanning velocities are high. The authors therefore developed a system of slow scanning which provides a scanning field with a 1 : 1 format and a resolution of 200 - 300 lines at 1 frame/min. The area of the scanning

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field on the object amounts to 0.04 to 0.25 mm^2. Under these conditions, the dead time of the counter tube imposes practically no limit on the resolution of the characteristic X-rays patterns. A block of slow sweeps serves for observing the images visually, and is provided with a moving film camera with a large afterglow. A second moving film camera, synchronized with the first, records the images photographically; it focuses the spot sharply and has a high accelerating voltage. The characteristic X-ray pattern were also recorded using an NaI-crystal scintillation counter which worked satisfactorily at wavelengths below 1.5 Å. The sharpness and contrast of the images obtained due to the secondary electrons were increased by a special device for correcting the frequency characteristics of the video amplifier block. This was done by filtering out signals between 25 and 150 cps and those near to 5 Mcs. The improvements of the basic elements of the X-ray microanalyzer made it possible to obtain characteristic X-rays patterns for the first time, and to undertake comparitive studies of a few objects on the basis of the microphotographs. Besides making it possible to obtain reflected characteristic electron beam and X-ray patterns for macroscopic surfaces, the instrument also permits the vizualization of p - n transitions in

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A modified raster microscope - local ... S/048/63/027/003/020/025
B106/B238

semiconductors. The band width of the barrier layer depends on the applied voltage and can easily be determined. The authors are now working to develop a raster microscope - local X-ray analyzer as an industrial model; this will feature magnetic optics, thus making it possible to achieve high resolution and a much higher current density in the electron probe. There are 5 figures.

Card 3/3

KUSHNIR, Yu.M.; FETISOV, D.V.; DER-SHVARTS, G.V.; POCHTAREV, B.I.; TOKAREV, P.D.; RASPLETIN, K.K.; SPEKTOR, F.U.; GUROVA, R.P.; POSTNIKOV, Ye.B.; OSIPOV, V.N.; PAVLOV, V.A.; POGUDINA, M.V.

Combined scanning electron microscope and X-ray microanalyzer with magnetic electron optics. Izv. AN SSSR. Ser. fiz. 27 no.9: 1166-1172 S '63. (MIRA 16:9)
(Electron microscope) (X-ray spectroscopy)

L 19954-63 BDS

ACCESSION NR: AP3007823 S/0048/63/027/009/1184/1187 57 55

AUTHOR: Rozenfel'd, L.B.; Kushnir,Yu.M.; Zaytsev,P.V.; Titov,L.A.; Bezlepkin,S.V.; Polynk, E.V.

TITLE: Reflecting electron microscope adapted for examination of strained specimens /Report, Fourth All-Union Conference on Electron Microscopy held in Sumy* 12-14 March 1963/

SOURCE: AN SSSR, Izv.Ser.fizicheskaya, v.27, no.9, 1963, 1184-1187

TOPIC TAGS: electron microscopy, strain, strength of material

ABSTRACT: The paper gives the results of testing a reflecting electron microscope adapted for observation of strained specimens. A reflecting electron microscope described earlier (Radiotekhnika i elektronika, No.8, 1359, 1961 and Zavodskaya laboratoriya, 27, 1528, 1961) with a maximum tilt angle of 22° was modified for this purpose by provision of a special object holder and incorporation of a two-slit projector lens to provide better resolution over the entire field. The optimum shape for the specimens was found on the basis of extensive experimentation; this is shown in Figure 1 of the Enclosure. The specimen holder and straining de-

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L 19954-63
ACCESSION NR: AP3007823

vice is shown in Figure 2. The strain is applied by means of a synchronous electric motor rotating the screw shaft. The deformation provess was recorded by internal photography and by photography (still and motion picture) of a glass screen mounted in the bottom of the internal camera and viewed by means of a mirror. A series of four micrographs of the surface of a specimen of heat-resisting alloy, lightly etched before straining, is reproduced. The electron micrographs reveal some details not disclosed by an optical microscope. "In conclusion, the authors express their gratitude to G.V.Der-Shvarts and V.P.Rachkov for calculation of the two-slit achromatic projector lens." Orig.art.has: 4 figures.

ASSOCIATION: none

SUBMITTED: 00

DATE ACQ: 07Oct63

ENCL: 01

SUB CODE: ML, SD

NO REF SOV: 002

OTHER: 000

Card2/2

KUSHNIR, Yu.M.; KABANOV, A.N.; LEVKIN, N.P.; CHERNOVA-STOLYAROVA, Ye.Ye.

Electron spectrograph for the EG-100A electron diffraction camera. Izv. AN SSSR. Ser. fiz. 27 no.9:1196-1198 S '63. (MIRA 16:9)
(Electron diffraction apparatus) (Electrons—Spectra)

KUSHNIR, Yu.M.; KABANOV, A.N.; KRUTYAKOVA, L.N.; TARASOVA, L.V.

Elastic and inelastic scattering of reflected electrons. Izv. AN SSSR. Ser. fiz. 27 no.9:1235-1238 S '63. (MIRA 16:9)
(Electrons--Scattering)

ACCESSION NR: AP4043680 S/0109/64/009/008/1458/1464

AUTHOR: Rozenfel'd, L. B.; Kushnir, Yu. M.

TITLE: Elementary theory of reflection of electrons by a solid-body surface (spatial distribution)

SOURCE: Radiotekhnika i elektronika, v. 9, no. 8, 1964, 1458-1464

TOPIC TAGS: electron reflection, electron theory, electron reflection by solid

ABSTRACT: Based on the recent theory of the inelastic scattering of electrons by a solid body, as developed by T. K. Everhart (J. Appl. Phys., 1960, 31, 8, 1483) and N. G. Nakhodkin, et al. (Fizika tverdogo tela, 1962, 4, 6, 1514), a new theory of the spatial distribution of reflected electrons is presented. Formulas are developed for estimating the angular distribution of all reflected electrons, or a part of them having energies within a specified range; the distribution depends on the angle of incidence of the primary electrons; the

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ACCESSION NR: AP4043680

electrons may be reflected by the solid-body proper or by a thin film covering its surface. Estimated spatial-distribution diagrams agree qualitatively with some published experimental diagrams. Quantitative discrepancies are explained. "In conclusion, the authors wish to thank V. P. Rachkov, N. B. Kagan, G. D. Pravdolyubova, and T. I. Rukavishnikova for their help with the calculations and drawing diagrams." Orig. art. has: 4 figures and 24 formulas.

ASSOCIATION: none

SUBMITTED: 08Jun63 ENCL: 00

SUB CODE: NP NO REF SOV: 003 OTHER: 003

Card 2/2

ROZENFEL'D, L.B.; KUCHNIR, Yu.M.

Elementary theory of the reflection of electrons from the surface of a solid (spatial distribution). Radiotekh. i elektron. 9 no.8:1458-1464 Ag '64. (MIRA 17:10)

KUSHNIR, Yu.M.; ROZENFEL'D, A.M.; ZAYTSEV, P.V.; KOP'YEVA, N.A.; ROZENFEL'D, L.B.

Attachment for the EEM-50 emission microscope for studying secondary emitters. Zav.lab. 30 no.12:1512-1513 '64.

(MIRA 18:1)

KUSHNIR, Yu.M.; FETISOV, D.V.; DER-SHVARTS, G.V.; POCHTAREV, B.I.; TOKAREV, P.D.; RASPLETIN, K.K.; GUROVA, R.P.; POSTNIKOV, Ye.B.

The REMP-1 scanning-type electronic microprobe instrument. Zav.lab. 30 no.12:1510-1512 '64. (MIRA 18:1)

ROZENFEL'D, L.B.; KAGAN, N.B.; KUSHNIR, Yu.M.

Study of ion-electron emission energy spectra using an electronic emission microscope. Radiotekh. i elektron. 11 no. 2:287-290 F '66 (MIRA 19:2)

1. Submitted June 8, 1963.

L 27544-66 EWT(1) IJP(c) AT

ACC NR: AP6007506 SOURCE CODE: UR/0109/66/011/002/0287/0290

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B

AUTHOR: Rozenfel'd, L. B.; Kagan, N. B.; Kushnir, Yu. M.

ORG: none

TITLE: Investigation of the energy spectra of ion-electron emission in an emission-type electron microscope

SOURCE: Radiotekhnika i elektronika, v. 11, no. 2, 1966, 287-290

TOPIC TAGS: electron microscope, energy spectrum, ion bombardment

ABSTRACT: The results are presented of an experimental investigation of the energy spectra of secondary electrons arising from the bombardment of specimens by a positive-ion beam, in an electron emission microscope. Energy spectra of W, Mo, Ta, Ti, Ni, brass were studied (preheated to 200—300C); bombardment by ions of air, He, A with energies of 5—10 kev; primary-beam angle, 6—16°. It was found that the minimum energy spread of the secondary electrons occurred with the lowest (5 kev) primary energy and the greatest (16°) grazing angle. Orig. art. has: 5 figures.

SUB CODE: 09 / SUBM DATE: 08Jun63 / ORIG REF: 001 / OTH REF: 004

Card 1/1 BLG

UDC: 537.533.35

L 36554-66 EWT(1)

ACC NR: AP6015760 (A,N) SOURCE CODE: UR/0048/66/030/005/0764/0765

AUTHOR: Kabanov, A. N.; Fetisov, D. V.; Tokarev, P. D.; Glushkova, E. D.; Kushnir, Yu. M.

ORG: none

TITLE: The MESEM-A-40 electrostatic electron microscope energy analyzer /Report, Fifth All-Union Conference on Electron Microscopy held in Sumy 6-8 July 1965/

SOURCE: AN SSSR. Izvestiya, Seriya fizicheskaya, v. 30, no. 5, 1966, 764-765

TOPIC TAGS: electron microscope, electron diffraction, electron scattering, inelastic scattering, electron energy

ABSTRACT: A type MESEM-40 electrostatic electron microscope, described elsewhere by V.I.Milyutin, D.V.Fetisov, K.K.Raspletin, F.U.Spektor, and B.I.Pochtarev (Izv. AN SSSR. Ser. fiz., 23, 454 (1959)), has been modified for use as an electrostatic energy analyzer for investigation of inelastic scattering of electrons. The modified instrument can also be used as an electron diffraction camera. Two auxiliary sections were fabricated to replace the section of the MESEM-40 microscope that contains the objective, intermediate, and projection lenses. One auxiliary section is inclined and contains the condensing lens for work with electron reflection. The other auxiliary section contains the specimen holder, the mechanism for controlling the motion of the

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L 36554-66

ACC NR: AP6015760

slit, the objective, and the analyzer lens. The accelerating potential can be continuously varied; its maximum value is 40 kV. The microscope can produce light field, dark field, and steroscopic images at magnifications from 3000 to 11 000 and with a resolution of 40-50 A. The energy resolution of the analyzer is 0.5-0.7 eV. The electron microscope images, electron diffraction patterns, and electron energy spectra are recorded photographically. Orig. art. has: 1 figure.

SUB CODE: 20/ SUBM DATE: 00/ ORIG REF: 002/ OTH REF: 003

Card 2/2 mlp

L 08093-67 EWT(l)/EWT(m)/EWP(t)/ETI IJP(c) JD

ACC NR: AP6029900 SOURCE CODE: UR/0413/66/000/015/0063/0064

INVENTOR: Kushnir, Yu. M., Rozenfel'd, L. B.; Der-Shvarts, G. V.; Kagan, N. B. 36 13

ORG: none

TITLE: Microscope of the ion emission type. Class 21, No. 184366

SOURCE: Izobret prom obraz tov zn, no. 15, 1966, 63-64

TOPIC TAGS: microscope, field emission microscope, ion emission

ABSTRACT: The proposed microscope of the ion emission type contains an axisymmetric electrostatic optical system, a diaphragm, a device for separating ions of specific mass from the ion beam, an ion collector, such as the first dynode of a secondary electron multiplier, an amplifier, and a recording unit (see Fig. 1). To increase microscope resolution and to make possible the observation of the distribution of various chemical elements on the surface of the sample, a scanning system, synchronized with the control unit and admitting through the diaphragm an enlarged ion image for every element, is used in the microscope. For the same purpose, the device which

Card 1/2 UDC: 621.385.833

L 08073-67

ACC NR: AP6029900

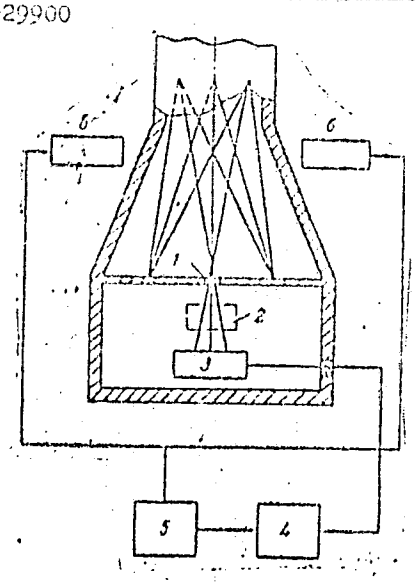

Fig. 1. Ion emission microscope

1 - Diaphragm; 2 - system for separating ions of specific cross from the ion beam; 3 - ion collector; 4 - amplifier; 5 - recording unit; 6 - scanning system.

separates the ions of specific mass from the ion beam is placed between the diaphragm and the ion collector. Orig. art. has: 1 figure. [JR]

SUB CODE: 20/ SUBM DATE: 25Sep64/

Card 2/2

40082

16.3500

S/020/62/145/004/004/024
B112/B102

AUTHOR: Kushnirchuk, I. F.

TITLE: A partial differential equation of higher order

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 145, no. 4, 1962, 727 - 730

TEXT: The equation

$$\sum_{k=0}^{n} p_k(x)\,\partial^n f/\partial w^k \partial x^{n-k} + \sum_{l+m\leqslant n-1} p_{lm}(w,x)\partial^{l+m} f/\partial w^l \partial x^m = h(w,x) \quad (5)$$

is considered. After demonstrating the uniqueness of the Cauchy problem pertaining to Eq. (5), the author shows that Eq. (5) can be reduced to the Bianchi equation $(-1)^n \partial^n F/\partial t_1 \ldots \partial t_n + \sum_{|K|\leqslant n-1} q_K(t) D_K F = H(t)$ for $n = 3$ by the transformation $w = w_0 + \int_{x_0}^{x} c(\{\})d\{\} - \gamma_1 t_1 - \gamma_2 t_2 - \gamma_3 t_3$, $x = x_0 - t_1 - t_2 - t_3$. There is 1 figure.

ASSOCIATION: Chernovitskiy gosudarstvennyy universitet (Chernovtsy State University)

Card 1/2

A partial differential ...

S/020/62/145/004/004/024
B112/B102

PRESENTED: March 10, 1962, by V. I. Smirnov, Academician

SUBMITTED: March 6, 1962

Card 2/2

KUSHNIRCHUK, I.F.

Cauchy problem for equations of higher order with multiple characteristics. Pribl. metod. resh. diff. urav. no.1:54-59 '63 (MIRA 18:2)

KUSHNIRCHUK, I.F.

Cauchy problem for a class of partial differential equations fo higher order. Dop. AN URSR no.6:720-725 '63 (MIRA 17:7)

1. Chernovitskiy gosudarstvennyy universitet. Predstavlano akademikom AN UkrSSR B.V. Gnedenko [Hnedenko, B.V.]

KUSHNIRCHUK, I.F.

Characteristics of one differential equation of high order.
Pribl.metod.resh.diff.urav. no.2:70-84 '64.
(MIRA 18:4)

L 23867-65 EWT(d) Pg-4 IJP(c)

ACCESSION NR: AP4046126 S/0199/64/005/005/1061/1070

AUTHOR: Kushnirchuk, I. F.

TITLE: The Cauchy problem for one n-th order partial differential equation

SOURCE: Sibirskiy matematicheskiy zhurnal, v. 5, no. 5, 1964, 1061-1070

TOPIC TAGS: partial differential equation, Cauchy problem, differential equation, successive approximation

ABSTRACT: The author derives an explicit solution to the Cauchy problem for the equation

$$\prod_{l=1}^{n}\left(\frac{\partial}{\partial x}-\lambda_l(x)\frac{\partial}{\partial w}\right)f(w,x)=0 \qquad (1)$$

with the initial conditions:

$$f(w,0)=f_0(w),\ \left.\frac{\partial f}{\partial x}\right|_{x=0}=f_1(w),\ \ldots,\ \left.\frac{\partial^{n-1}f}{\partial x^{n-1}}\right|_{x=0}=f_{n-1}(w) \qquad (2)$$

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where x(0≤x<b) is real and w is complex (and contained in a singly connected domain G; moreover, it is assumed that

$$\lambda_j(x) \equiv \lambda(x) + \gamma_j, \quad j = 1, 2, \ldots, n; \quad 0 \leqslant x < b, \tag{3}$$

where $\lambda(x)$ is a complex valued (in particular, real) n-1 times differentiable function on $[0, b]$ and the γ_j (j=1, 2, ..., n) are different complex (in particular, real) numbers. For the case of constant coefficients p_k, the solution is

$$f(w, x) = (-1)^{n-1} \sum_{s=1}^{n} \frac{(\Lambda - (\lambda_s), n-1)}{\prod_{j=1}^{n}{}' (\lambda_s - \lambda_j)} f_s(w + \lambda_s x) + \ldots \tag{4}$$

$$+ \sum_{s=1}^{n-1} (-1)^{n-m-1} \sum_{s=1}^{n-m} \frac{(\Lambda - (\lambda_s), n-m-1)}{\prod_{j=1}^{n-m}{}' (\lambda_s - \lambda_j)} \int_0^x dx_n \int_0^{x_n} dx_{n-1} \ldots$$

$$\ldots \int_0^{x_{n-m+2}} f_m\left(w + (\lambda_s - \lambda_{n-m+1}) x_{n-m+1} + \sum_{k=n-m+1}^{n-1} (\lambda_k - \lambda_{k+1}) x_{k+1} + \lambda_n x\right) dx_{n-m+1}.$$

Determinants can be used to reduce formula (4) to the form

$$\int_0^{x_{n-m+1}} \cdots \int \begin{vmatrix} 1 & 1 & \cdots & 1 \\ \lambda_1 & \lambda_2 & \cdots & \lambda_{n-m} \\ \lambda_1^2 & \lambda_2^2 & \cdots & \lambda_{n-m}^2 \\ \cdots & \cdots & \cdots & \cdots \\ \lambda_1^{n-m-1} & \lambda_2^{n-m-1} & \cdots & \lambda_{n-m}^{n-m-1} \\ A_{n-m}(\lambda_1) & A_{n-m}(\lambda_2) & \cdots & A_{n-m}(\lambda_{n-m}) \end{vmatrix} dx_{n-m+1} \cdots \qquad (5)$$

where $A_{n-m}(\lambda_s) = (A-(\lambda_s),\ n-m-1) f_{n-m}(w + (\lambda_s - \lambda_{n-m+1}) x_{n-m+1} + \sum_{k=n-m+1}^{n-1} (\lambda_k - \lambda_{k+1}) x_{k+1} + \lambda_n x),\ s = 1, 2, \ldots, n-m;$

where $A_n(\lambda_s) = (A-(\lambda_s),\ n-1) f_n(w + \lambda_n x)$ for m=0 and Δ_{n-m} is the (n-m)-th order Vandermonde determinant in which the entries in the second row are the numbers $\lambda_1, \lambda_2, \ldots, \lambda_{n-m}$. For the case of p_k that are functions of x, the solution takes

the form

$$f(\omega, x) = \sum_{m=0}^{n-1} (-1)^{n-m-1} \sum_{l=1}^{n-m} \frac{(\Lambda(0) - (\lambda_s(0)), n-m-1)}{\prod_{j=1}^{n-m}{}' (\lambda_s - \lambda_j)} \int_0^x dx_n \int_0^{x_n} dx_{n-1} \cdots$$

$$\cdots \int_0^{x_{n-m+1}} f_m \left(\omega + \int_0^{x_{n-m+1}} \lambda_s(\xi)\, d\xi + \sum_{k=n-m+1}^{n} \int_{x_k}^{x_{k+1}} \lambda_k(\xi)\, d\xi \right) dx_{n-m+1} +$$

$$+ \sum_{m=0}^{n-2} \sum_{l=1}^{n-m-1} \sum_{\mu=0}^{n-m-l+1} M_{n-m-l,\mu}^{(n-l+1)} \sum_{s=l-1}^{n-m-\mu-1} \frac{1}{\prod_{j=1}^{n-m-\mu-1}{}' (\lambda_s - \lambda_j)} \int_0^x dx_n \int_0^{x_n} dx_{n-1} \cdots$$

$$\cdots \int_0^{x_{n-m-\mu+1}} f_m \left(\omega + \int_0^{x_{n-m-\mu+1}} \lambda_s(\xi)\, d\xi + \sum_{k=n-m-\mu+1}^{n} \int_{x_k}^{x_{k+1}} \lambda_k(\xi)\, d\xi \right) dx_{n-m-\mu}.$$

The solution obtained by the author plays the role of the zero-th order of approximation for successive approximations applied to the equation

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$$\sum_{k=0}^{n} p_k(x)\frac{\partial^n f}{\partial w^k \partial x^{n-k}} + \sum_{l+m=0}^{n-1} p_{lm}(w, x)\frac{\partial^{l+m} f}{\partial w^l \partial x^m} = h(w, x), \quad p_0 \equiv 1, \qquad (6)$$

with the expression

$$\prod_{j=1}^{n}\left(\frac{\partial}{\partial x} - \lambda_j(x)\frac{\partial}{\partial w}\right) f(w, x) \equiv \sum_{k=0}^{n} p_k(x)\frac{\partial^n f}{\partial w^k \partial x^{n-k}} + \sum_{k+l=1}^{n-1}\sum^{n} \psi_{kl}(x)\frac{\partial^{k+l} f}{\partial w^k \partial x^l}, \qquad (7)$$

substituted for the higher-order terms, where the $\lambda_j(x)$ $(j=1, 2, \ldots, n)$ are the roots of the characteristic equation and are naturally assumed to be different and the $\psi_{kl}(x)$ contain up to (n-1)-th order inclusive derivatives of these roots. It is noted that the results of this article can be used to prove local equivalence of the operator

$$B = \prod_{k=1}^{n}\left(\frac{\partial}{\partial x} - \lambda_k(x)\frac{\partial}{\partial w}\right) + \sum_{l+m=0}^{n-1} p_{lm}(w, x)\frac{\partial^{l+m}}{\partial w^l \partial x^m}$$

L 23867-65

ACCESSION NR: AP4046126

to the simple operator

$$A = \prod_{k=1}^{n} \left(\frac{\partial}{\partial x} - \lambda_k(x) \frac{\partial}{\partial \sigma} \right)$$

in the class of operator-analytic functions. "The author would like to thank M. K. Fage for his direction of the work and help during its formulation".
Orig. art. has: 18 equations
ASSOCIATION: None

SUBMITTED: 30May63 ENCL: 00

SUB CODE: MA NO REF SOV: 005 OTHER: 001

Card 6/6

L 40798-66 EWT(m)/T/EWP(w)/EWP(t)/ETI IJP(c) JD

ACC NR: AP6021000 SOURCE CODE: UR/0125/66/000/006/0010/0015 49 48

AUTHOR: Grabin, V. F.; Vasil'yev, V. G.; Kushnirenko, A.; Zamkov, V. N.; Gordonnaya, A. A.

ORG: Institute of Electric Welding im. Ye. O. Paton, AN UkrSSR (Institut elektrosvarki im. Ye. O. Patona AN UkrSSR)

TITLE: Kinetics of phase transformations in welded joints of VT15 titanium alloy

SOURCE: Avtomaticheskaya svarka, no. 6, 1966, 10-15

TOPIC TAGS: titanium alloy, phase composition, metal joining, weld evaluation / VT15 titanium alloy, EG-100A electron diffraction camera

ABSTRACT: The mechanical properties of the welded joints of this alloy are largely determined by the decomposition of β-phase and the properties of the products of its transformation. Hence, the determination of the temperature intervals of formation of these products and of their effect on weld properties is highly important, since it makes possible not only the assessment of the role played by intermediate phases in the embrittlement of weld metal but also the determination of the ways and means of perfecting the welding techniques so as to

UDC: 621.791:620.181:669.295

Card 1/2

L 1.0790-66

ACC NR: AP6021000

assure welds of improved quality. Accordingly, the authors investigated the kinetics of the β-phase in welded joints (obtained by submerged arc welding) of VT15 alloy under continuous heating. To this end the welded joints were subjected to dilatometric studies (with the aid of a vacuum differential dilatometer); the phase composition was investigated with the aid of an EG-100A electron diffraction camera; and the microstructure, with the aid of optical and electron microscopes. Findings: the presence of the martensite transformation $\beta \rightarrow \omega$ at 450°C and the possibility of the formation of $TiCr_2$ during continuous heating are established. It is further shown that the impact strength and plasticity of these welded joints may be optimized by quenching from 900°C since then the temperature interval of $\beta \rightarrow \omega$ transformation is lower (~ 200-350°C) while the temperature interval of $\alpha \rightarrow \beta$ transformation is higher (800-840°C). Orig. art. has: 7 figures, 1 table.

SUB CODE: 13,11,20/ SUBM DATE: 19Nov65/ ORIG REF: 007/ OTH REF: 003

Card 2/2

L 22097-66 EWT(1)/ETC(f)/EWG(m)/ETC(m)-6 JW

ACC NR: AP6012665 SOURCE CODE: UR/0020/65/161/001/0037/0038

50
49
13

AUTHOR: Kushnirenko, A. G.

ORG: Moscow State University im. M. V. Lomonosov (Moskovskiy gosudarstvennyy universitet)

TITLE: Upper limit of the entropy of a classical dynamic system

SOURCE: AN SSSR. Doklady, v. 161, no. 1, 1965, 37-38

TOPIC TAGS: entropy, thermal expansion, homomorphism

ABSTRACT: "Classical dynamic system" is the name which the author gives to a measure μ-preserving differentiable homeomorphism T of an n-dimensional compact Riemannian manifold M (the measure μ is given by the Riemannian metric and $\mu(M) = 1$). Let Δ be an $(n-1)$-dimensional element on M. Its $(n-1)$-dimensional volume (unoriented) is called the area and is denoted as $S(\Delta)$. The transformation T changes $S(\Delta)$. It follows from the compactness of M that the modules of expansion of the area has some number as its upper limit. This number is designated λ, such that

$$S(T\Delta) \leqslant \lambda S(\Delta).$$

The author then formulates and proves Theorem 1: The entropy $h(T)$ of a classical dynamic system is finite and

$$h(T) \leqslant n \log \lambda$$

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L 22097-66
ACC NR: AP6012665

(binary logarithm). Theorem 1 is also true for endomorphisms, as well as for a manifold whose boundary has a finite area. The author thanks V. I. Arnol'd for organizing the problem. Orig. art. has: 9 formulas. [JPRS]

SUB CODE: 20 / SUBM DATE: 01Oct64 / ORIG REF: 001

Card 2/2 BLG

VONSOVSKIY, S.V.; IRKHIN, Yu.P.; KUSHNIRENKO, A.N.; TUROV, Yu.A.

Multielectron theory of semiconductors. Part 1. Fiz.met. i metalloved.3 no.3:385-394 '56. (MIRA 10:3)

1. Institut fiziki metallov Ural'skogo filiala AN SSSR.
(Electrons) (Semiconductors)

AUTHORS: Vonsovskiy, S. V. and Kushnirenko, A. N. 126-5-3-3/31

TITLE: Excited States in an Atomic Semiconductor in a Multi-electron Model (Vozbuzhdennyye sostoyaniya atomnogo poluprovodnika v mnogoelektronnoy modeli)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1957, Vol V, Nr 3, pp 395-401 (USSR)

ABSTRACT: Configuration space concepts are applied to an inherent semiconductor, in which each lattice site is assumed occupied by two (non-degenerate) s-state electrons with antiparallel spin projections. The first excited p state (assumed non-degenerate) is included. The two possible species of excitation in such crystal are Frenkel excitons (singlet or triplet states), and electron-hole conduction. The work extends earlier studies on a one-electron model, and on a two-electron model neglecting conduction. The problem is initially formulated in Slater determinant form (Eq.(1.1)) for Frenkel excitons and analysis (neglecting magnetic interactions) for the wave-functions and energy is then standard. It is then shown that the Frenkel excitons can carry no current. The electron-hole type of excitation is then considered more briefly, starting from the excited-state eigenfunction,

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126-5-3-3/31

Excited States in an Atomic Semiconductor in a Multi-electron Model

Eq.(2.1). It is demonstrated also that there is no essential physical difference between Frenkel and Mott excitons, which can only be done from a multi-electron model.
There are 11 references, 10 Soviet, 1 English.

ASSOCIATION: Institute of Metal Physics, Ural Branch of the Ac.Sc., U.S.S.R. (Institut Fiziki Metallov Ural'skogo Filiala AN SSSR)

SUBMITTED: April 8, 1957.

1. Semiconductors--Excitation 2. Semiconductors--Electron transitions

Card 2/2

KUSHNIRENKO, A.N.

Energy spectrum of an atomic semiconductor in the polyelectron theory. Part 1. Nauk. zap. Kyiv. un. 16 no.16:211-224 '57.
(MIRA 13:3)

(Semiconductors)

KUSHNIRENKO, A.N.

AUTHOR: Kushnirenko, A. N. 20-6-11/47

TITLE: The Quadrupole Moments of Nuclei (Kvadrupol'nyye momenty yader).

PERIODICAL: Doklady AN SSSR, 1957, Vol. 117, Nr 6, pp. 963 - 964 (USSR)

ABSTRACT: The electric quadrupole moments of the nuclei were investigated in various earlier papers (references 1 to 8). As this problem was not definitely solved within the framework of the shell model, it is another time investigated here by the author. The wave function of the nucleus is here represented in the form of a linear combination of the Slater functions combined of the one nucleon wave functions. The one nucleon wave functions are here given for the case of the strong spin-orbit coupling. The coefficients of the development of the wave function of the nucleus according to the Slater functions is here determined from the conservation theorems of the projection of the angular momentum to the z-axis, of the square of the angular momentum and of the square of the isotopic spin of the nucleus. The author only uses the wave function and the general formula for the quadrupole moment; the formula for the quadrupole moment of the nucleus thus found is explicitly written down. A table contains the electrical quadrupole moments of some light nuclei calculated by means of this formula. In the presence of mixed shell con-

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The Quadrupole Moments of Nuclei. 20-6-11/47

figurations an additional electrical quadrupole moment is produced. There are 1 table, 1o references, 2 of which are Slavic.

ASSOCIATION: Kiyev State University imeni T. G. Shevchenko, (Kiyevskiy gosudarstvennyy universitet im. T. G. Shevchenko).

PRESENTED: June 2o, 1957, by N. N. Bogolyubov, Academician

SUBMITTED: May 3o, 1957

AVAILABLE: Library of Congress

Card 2/2

37616

24 7700

S/044/62/000/004/077/099
C111/C222

AUTHOR: Kushnirenko, A.N.

TITLE: The energetic spectrum of an atomic semi-conductor in polyelectronic theory II

PERIODICAL: Referativnyy zhurnal, Matematika, no. 4, 1962, 90, abstract 4B428. ("Visnyk. Kyivs'k. un-tu", 1958, no. 1, Ser. astron. matem. ta mekhan., no. 1, 63 - 74)

TEXT: For part I see "Matematychn. zbirnyk KDU", 1957, no. 10. The author examines the energetic spectrum of a crystal in which at every lattice point there are two valence electrons. It is shown that in the vicinity of the basic state there exist Bose and Fermi branches of the spectrum of elementary excitations independent of each other. The excitations of the Fermi branch are examined extensively; they have characteristics of currents and are responsible for the electronic properties of a semi-conductor.

[Abstracter's note : Complete translation.]

Card 1/1

S/058/62/000/005/024/119
A001/A101

AUTHOR: Kushnirenko, A. N.

TITLE: Electric nuclear quadrupole moments

PERIODICAL: Referativnyy zhurnal, Fizika, no. 5, 1962, 23, abstract 5B177 ("Visnyk Kiyvs'k. un-tu", 1959, no. 2, ser. astron., matem. ta mekhn. no. 1, 85-90, Ukrainian, Russian summary)

TEXT: Quadrupole moments of atomic nuclei were theoretically investigated. Nuclear wave function is expanded into series by wave functions of the undisturbed problem; the latter is presented by a determinant compiled of single-nucleon functions in a central-symmetric field with strong spin-orbit coupling. Using the constructed nuclear wave function, the author derived a general formula for nuclear quadrupole electric moment, by means of which the following anomalies can be explained: 1) existence of quadrupole moments in some nuclei with closed proton subshells; 2) anomalously large positive quadrupole moments of some strongly deformed Z-odd nuclei.

[Abstracter's note: Complete translation]

Card 1/1

KUSHNIRENKO, Anatoliy Nikanorovich; MIRONETS, Ye.M., red.; KHOKHANOVSKAYA, T.I., tekhn. red.

[Electrodynamics] Elektrodinamika. Kiev, Izd-vo Kievskogo univ., 1961. 234 p. (MIRA 15:1)

(Electrodynamics)

S/139/61/000/002/007/018
E032/E414

24.4500

AUTHOR: Kushnirenko, A.N.

TITLE: On the Quantum Field Theory of the Deuteron

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1961, No.2, pp.52-54

TEXT: The energy operator for a system consisting of two nucleons interacting through a scalar meson field is taken to be of the form

$$\hat{H} = -\frac{h^2}{2m}\nabla_1^2 - \frac{h^2}{2m}\nabla_2^2 + \frac{1}{2}\int\left[\hat{\pi}^2 + c^2(\nabla\hat{\varphi})^2 + c^2\mu^2\hat{\varphi}^2\right]d\bar{r} + \tag{2.1}$$

$$+ cg\hat{\varphi}(\bar{r}_1) + cg\hat{\varphi}(\bar{r}_2),$$

where m is the nucleon mass, ∇_i^2 is the Laplace operator acting on the coordinates of the i-th nucleon, $2\pi h$ is Planck's constant, g is the coupling constant, $\mu = m_{\pi}c/h$, m_{π} is the meson mass, c is the velocity of light and $\hat{\pi}$, $\hat{\varphi}$ are the scalar meson field operators. The Schrodinger equation in the momentum space is then of the form

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On the Quantum Field ...

$$\left[\left(\frac{h^2p_1^2}{2m}+\frac{h^2p_2^2}{2m}+\sum_{(\kappa)}h\omega_\kappa\hat{c}_\kappa^+\hat{c}_\kappa\right)\Psi(p_1,p_2;\ldots)+\right.$$

$$\left.+\frac{cg\sqrt{h}}{V\overline{V}}\sum_{(\kappa)}\frac{\hat{c}_\kappa+\hat{c}_{-\kappa}^+}{\sqrt{2\omega_\kappa}}\left[\Psi(p_1-k,p_2;\ldots)+\Psi(p_1,p_2-k;\ldots)\right]\right]= \quad (2.2)$$

$$=E_d\Psi(p_1,p_2;\ldots),$$

where p_1 and p_2 are the wave numbers of the nucleons, $h\omega_k$ is the meson energy, V is the normalization volume and $\hat{c}_k^+$, $\hat{c}_k$ are the creation and annihilation operators. The wave function of the system is written out in the form

$$\Psi(p_1,p_2;\ldots)=\Psi(p_1)\Psi(p_2)\left\{\Phi_0+\frac{1}{V\overline{V}}\sum_{(\kappa)}a(k)\Phi(\ldots 1_\kappa\ldots)\right\}, \quad (2.3)$$

where Φ_0 is the meson vacuum state vector and $\Phi(\ldots 1_k\ldots)$ is

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the meson field state vector in the presence of a single meson. For the sake of simplicity, the functions $\Psi(p_i)$ and $a(k)$ are taken to be of the form

$$\Psi(p) = e^{-\alpha p^2}, \quad a(k) = \beta e^{-\gamma k^2} \tag{2.4}$$

Using Eq.(2.2) - (2.4) the energy E_d is found to be

$$E_d = \frac{3\hbar^2}{4m\alpha} + \frac{\frac{g^2 c\sqrt{\hbar}}{\sqrt{\mu c}}[\pi(\alpha+2\gamma)]^{-3/4} + \frac{\mu\beta^2 c\,\hbar}{8(2\pi\gamma)^{3/4}}}{1+\frac{\beta^2}{8(2\pi\gamma)^{3/4}}} \tag{2.5}$$

Assuming that the dimensions of the meson cloud are of the same order of magnitude as the dimensions of the region in which the nucleons are localized, and that $\alpha = \gamma$, it is found that since

$$\frac{\partial E_d}{\partial \alpha} = 0 \quad \text{и} \quad \frac{\partial E_d}{\partial \beta} = 0 \tag{2.6}$$

On the Quantum Field ...

the values of α and β are

$$\alpha = 1.49 \times 10^{-26}\ \text{cm}^2, \quad \beta = -2 \times 10^{-19}.$$

Substituting these values into Eq.(5), it is found that $E_d = 3.8$Mev. In order to determine the binding energy, it remains to determine the energy of a nucleon interacting with the scalar meson field vacuum. The corresponding energy operator is

$$\hat{H} = -\frac{\hbar^2}{2m}\nabla_1^2 + \frac{1}{2}\int\left[\hat{\pi}^2 + c^2(\nabla\hat{\varphi})^2 + c^2\mu^2\hat{\varphi}^2\right]d\bar{r} + cg\,\hat{\varphi}(\bar{r}_1). \qquad (3.1)$$

The Schrodinger equation in the momentum space is

$$\left[\frac{\hbar^2 p^2}{2m} + \sum_{(\kappa)} \hbar\omega_\kappa \hat{c}_\kappa^+ \hat{c}_\kappa\right]\Psi(p;\ldots) + \qquad (3.2)$$

$$+\frac{cg\sqrt{\hbar}}{\sqrt{V}}\sum_{(\kappa)}\frac{\hat{c}_\kappa + \hat{c}_{-\kappa}^+}{\sqrt{2\omega_\kappa}}\Psi(p-k;\ldots) = E_n\Psi(p;\ldots).$$

Card 4/6

On the Quantum Field ...

Writing out the wave function for the nucleon in the form

$$\Psi(p;\ldots) = \Psi(p)\left\{\Phi_0 + \frac{1}{\sqrt{V}}\sum_{(k)} a(k)\Phi(\ldots 1_k \ldots)\right\}. \qquad (3.3)$$

and assuming Eq.(2.4), it is found that

$$E_n = \frac{3\hbar^2}{8m\alpha} + \frac{\dfrac{cG\hbar\beta}{2\sqrt{\mu}(3\pi\alpha)^{1/2}} + \dfrac{\mu\beta^2 c\hbar}{8(2\pi\alpha)^{1/2}}}{1 + \dfrac{\beta^2}{8(2\pi\gamma)^{1/2}}}. \qquad (3.4)$$

Assuming further that $\alpha = \gamma$, one finds from the relations

$$\frac{dE_n}{d\alpha} = 0 \text{ and } \frac{dE_n}{d\beta} = 0$$

that $\alpha = 10^{-27}\text{cm}^2$, $\beta = -4.5 \times 10^{-20}$. From this it follows

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On the Quantum Field ...

that $E_n = 4.4$ Mev, and choosing G so that $G = \frac{g}{\sqrt{hc}} = 1.6$

it is found that the deuteron binding energy is given by

$$E_{CB} = \left| E_d - 2E_n \right| \simeq 5 \text{ MeV} \qquad (3.5)$$

Since $E_d < 2E_n$ it follows that a system of two nucleons interacting with the mesonic vacuum can exist in a bound state. There is 1 Soviet reference.

ASSOCIATION: Kiyevskiy gosuniversitet imeni T.G.Shevchenko
(Kiyev State University imeni G.T.Shevchenko)

SUBMITTED: June 13, 1960

Card 6/6

S/139/62/000/002/013/028
E032/E514

AUTHOR: Kushnirenko, A.N.

TITLE: On the magnetic moment of a nucleon

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, no.2, 1962, 87-90

TEXT: The author reports a calculation of the contribution to the magnetic moment of a nucleon which is due to the interaction of the "bare" nucleon with the symmetric pseudoscalar meson-field (a pseudovector coupling of the field with the nucleon is assumed). The following three conservation laws are assumed: 1) parity conservation, 2) isotopic spin conservation, and 3) conservation of the total angular momentum. It turns out that the correction for the proton magnetic moment is ΔM_z = 2 n.m., whereas the experimental result is 1.7925 ± 0.0001 (proton) and 1.9128 ± 0.0001 (neutron).

ASSOCIATION: Kiyevskiy gosuniversitet imeni T. G. Shevchenko (Kiev State University imeni T. G. Shevchenko)

SUBMITTED: March 15, 1961

Card 1/1

KUSHNIRENKO, A.N.

Use of direct methods of mathematical physics in quantum physics.
Izv.vys.uch.zav.; fiz. no.4:16-20 '62. (MIRA 15:9)

1. Kiyevskiy gosudarstvennyy universitet imeni T.G. Shevchenko.
(Mathematical physics) (Quantum theory)

L 2724-66 EWT(1) IJP(c) GG

ACCESSION NR: AP5017173 UR/0139/65/000/003/0019/0026

AUTHOR: Kushnirenko, A. N. 44,55

TITLE: Use of direct methods of mathematical physics in the theory of quantum transitions. I. 21,44,55

SOURCE: IVUZ. Fizika, no. 3, 1965, 19-26

TOPIC TAGS: mathematical physics, variational method, least square method, S matrix, quantum theory

ABSTRACT: This is a continuation of an earlier paper by the authors (Izv. Vuzov SSSR, Fizika No. 4, 16, 1962), dealing with the application of methods of mathematical physics for the calculation of the S-matrix in quantum field theory in the presence of strong or intermediate coupling between the fields. This method is modified in the present article to eliminate some difficulties connected with the solution of nonlinear algebraic equations and with the use of variable integration constants. Among the approximations considered are the method of moments, the Bubnov-Galerkin method, and the variational methods such as the Ritz and the least-square methods. It is shown that the Bubnov-Galerkin method leads to simpler results. Orig. art. has: 40 formulas.

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New method for calculating the magnetic moment of the electron.
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